The August 14th Blackout – PJM Insights

Virginia Commission on Electric Utility Restructuring
October 14, 2003

The electrical system events of August 14, 2003 resulted in a blackout over broad portions of the Midwest and Northeast including parts of New York State, Ontario, Ohio, Michigan, New Jersey and Pennsylvania. While a number of possible contributing events within the affected regions occurred as early as mid-day, the direct sequence leading to the widespread outages occurred within 90 seconds at approximately 4:10 PM Eastern Daylight Time. Most of the PJM region (comprising all or parts of Virginia, West Virginia, Ohio, Maryland, Pennsylvania, Delaware, New Jersey and the District of Columbia) was not affected:

- Ninety three percent of PJM's load – about 59,000 MWs – including its entire load in Virginia was unaffected by the blackout. PJM lost approximately seven percent of its load – about 4,500 MWs. The loss of load occurred in Northeastern New Jersey and Northwestern Pennsylvania as control systems planned and overseen by PJM initiated the opening of transmission tie lines to New York and Ohio to isolate PJM from the regions experiencing severe voltage drops and line overloads.

- Immediately following the disturbance, PJM System Operators took actions to stabilize the electrical grid, maintain customer load, assist in load restoration within PJM and provide support to neighboring systems.

- With the exception of isolated parts of northern New Jersey, PJM member companies had restored power to all customers by 4:00 AM on August 15th.

A joint task force has been established by the Department of Energy (DOE), the North American Electric Reliability Council (NERC) and the Canadian Ministry of Natural Resources (MNR) to provide a formal review of the events leading to the blackout and to make recommendations for improvements to strengthen the reliability of the nation's electrical infrastructure. The task force issued a Sequence of Events document on September 12, 2003. While the exact mechanisms leading to the blackout will not be clear until the investigation work is completed, we can point to a number of specific items that worked in unison to enable the isolation of the cascading outage within a small portion of PJM and inhibit further spreading of the blackout within and beyond the Mid-Atlantic region.

Comprehensive Regional Planning Process – many of the "actions" taken by PJM to halt the cascading outages were taken weeks, months and years before the actual events of August 14th through PJM's Regional transmission Expansion Planning (RTEP) Process. PJM's planning process ensures that the transmission system is designed to survive the potential failure of its critical elements. PJM enhances the expertise of its transmission-owning members by planning across a larger footprint and considering a range of broad stakeholder input. The planning process and the integration of standards into the design, construction and maintenance of the transmission system insure an infrastructure capable of meeting the requirements of supply reliability and wholesale market operation.

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Coordinated Real-Time Operations – Operator actions well before the outage events ensured that the PJM system was operating within the boundaries of its planned capability and that the system was positioned to withstand unplanned events. PJM works collaboratively with its members and other regional entities to ensure the coordination of outages, maintain adequate reserves, monitor system conditions and react to contingency conditions. PJM maintains reliability in real-time through its sophisticated operation which integrates wholesale electric markets with the maintenance of reliability in its footprint. PJM's Energy Management System monitors the transmission system continuously. PJM's security analysis continuously simulates possible combinations of system facility outages within PJM and neighboring control areas. As a result, PJM is prepared to preclude overloads that could damage critical infrastructure and curtail customers' load.

An environment dedicated to **Continuous Improvement** – PJM has a long history of critical self-assessment and investment in improvement. PJM operations personnel and member company operators undergo extensive initial training, simulation based on-going training and periodic event drills to prepare for "worst case scenario" situations. Following a severe voltage disturbance in 1999, PJM initiated a root cause analysis that identified a number of critical changes in system modeling, operational procedures and analytical tools to prevent future similar events. Implementation of the outcomes of this analysis is viewed as a critical contributor to PJM's ability to withstand the events of August 14th

The August 14th disturbance demonstrates the highly interconnected nature of the electricity grid, in which operations in one state can have an effect far from the precipitating event. Developing RTOs with the tools to see the "big picture", and the authority to take proactive steps to mitigate disturbances is a critical step in improving the overall performance of the grid. PJM, as a fundamental part of plans to integrate additional transmission owners, has been working with the Midwest ISO to develop a Joint Operating Agreement and NERC Reliability Plans for the operation of their respective regions and for coordination between their regions. The implementation of the provisions of these agreements is a likely "first step" in providing the "big picture" and improved coordination necessary for sustaining and improving grid reliability.